Model No.: N154C1 -L01

CHI MEI
OPTOELECTRONICS CORP.

Preliminary

TFT LCD Preliminary Specification

MODEL NO.: N154C1 -L01

Customer : _____

Approved by : _____

Note :

Liquid Crystal Display Division	
QRA Dept.	PDD I Dept.
Approval	Approval

- CONTENTS -

Version 1.1

REVISION HISTORY

Version	Date	Page (New)	Section	Description
Ver 0.0	Aug. 30. '05	All	All	Tentative specification first issued.
Ver 1.0	Oct. 13. '05	All	All	Preliminary specification first issued.
		4.	1.4.	Modify Surface Treatment
		10.	3.2	Modify BACKLIGHT UNIT spec.
		17~19	5.5	Modify EDID DATA STRUCTURE
		22.	7.2.	Modify OPTICAL SPECIFICATIONS
		27.	9.	Packing specification changed.
Ver 1.1	Dec. 05. '05	All	All	Preliminary specification updated.
		6.	2.1	Modify ABSOLUTE RATINGS OF ENVIRONMENT.
		7.	2.2	Modify 2.2.2 BACKLIGHT UNIT
		10.	3.2	Modify 3.2 BACKLIGHT UNIT
		22.	7.2	Modify 7.2 OPTICAL SPECIFICATIONS
		28.	10.2	Modify 10.2 CARTON LABEL

Preliminary

1   GENERAL DESCRIPTION

1.1 OVERVIEW

N154C1 -L01 is a 15.4" TFT Liquid Crystal Display module with single CCFL Backlight unit and 30 pins LVDS interface. This module supports 1440 x 900 XGA mode and can display 262,144 colors. The optimum viewing angle is at 6 o'clock direction. The inverter module for Backlight is not built in.

1.2 FEATURES

- Thin and light weight

- WXGA+ (1440 x 900 pixels) resolution

- DE (Data Enable) only mode

- 3.3V LVDS (Low Voltage Differential Signaling) interface with 2 pixel/clock

- Support EDID Structure Version 1.3

1.3 APPLICATION

- TFT LCD Notebook

1.4 GENERAL SPECIFICATI0NS

Item	Specification	Unit	Note
Outline Dimension	344(W) x 222 (H)	mm	
Active Area	331.56 (H) x 207.225 (V)	mm	(1)
Bezel Opening Area	335 (H) x 210.7 (V)	mm	
Driver Element	a-si TFT active matrix	-	-
Pixel Number	1440 x R.G.B. x 900	pixel	-
Pixel Pitch	0.23025 (H) x 0.23025 (V)	mm	-
Pixel Arrangement	RGB vertical stripe	-	-
Display Colors	262,144	color	-
Transmissive Mode	Normally white	-	-
Surface Treatment	Hardness (3H), Glare ,Reflection=1.2 %	-	-

1.5 MECHANICAL SPECIFICATIONS

Item		Min.	Typ.	Max.	Unit	Note
Module Size	Horizontal(H)	343.5	344	344.5	mm	
	Vertical(V)	221.5	222	222.5	mm	(1)
	Depth(D)	---	---	6.2	mm	
Weight		---	530	540	g	-
I/F connector mounting position		The mounting inclination of the connector makes the screen center within ±0.5mm as the horizontal.				(2)

Note (1) Please refer to the attached drawings for more information of front and back outline dimensions.

Version 1.1

Issued Date: Dec.05, 2005
Model No.: N154C1 -L01

Preliminary

NOTES:
1.'*' MARKS THE DESIGN CRITICAL DIMENSION.
2.' P ' MARKS THE PROCESS CRITICAL DIMENSION.
3.MAX.SCREW LENGTH: 2.5 mm.
4.MAX.SCREW TORQUE: 2.0 kgf-cm.
5.SIGNAL INTERFACE CONNECTOR: FI-XB30SRL-HF11 (JAE)
6.CCFL CONNECTOR: BHSR-02VS-1 (JST)

(2) Connector mounting position

+/- 0.5mm

5 / 29

Version 1.1

Issued Date: Dec.05, 2005
Model No.: N154C1 -L01

Preliminary
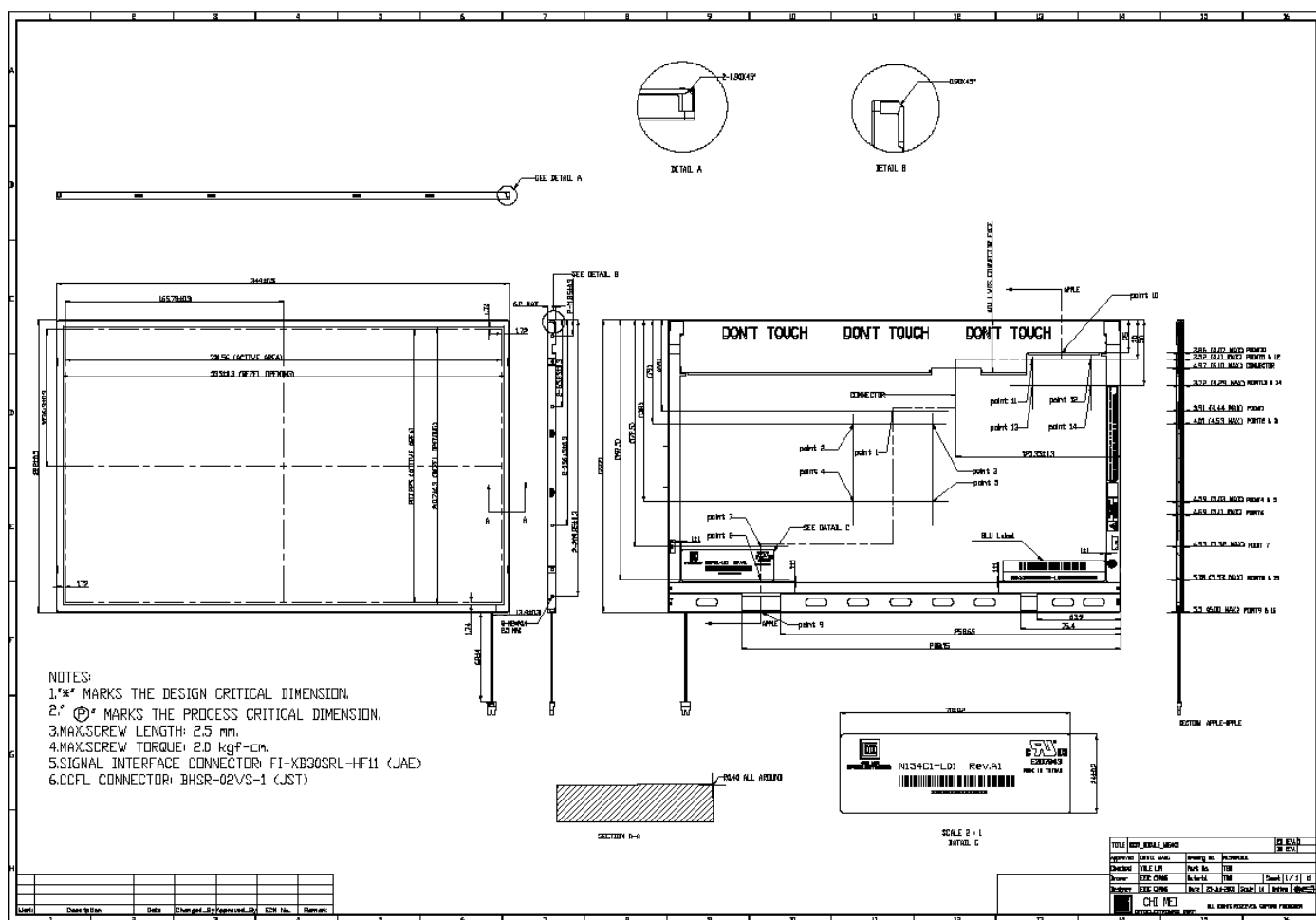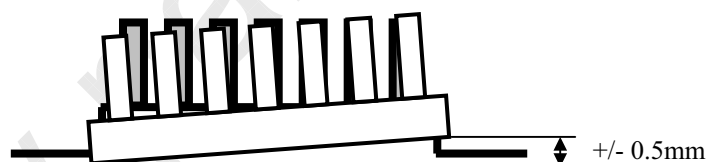
2 ABSOLUTE MAXIMUM RATINGS

2.1 ABSOLUTE RATINGS OF ENVIRONMENT

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Storage Temperature	T_{ST}	-20	+60	ºC	(1)
Storage Humidity	H_{ST}	10	90	%	
Operating Ambient Temperature	T_{OP}	0	+50	ºC	(1), (2)
Operating Humidity	H_{OP}	20	90	%	
Shock (Non-Operating)	S_{NOP}	-	200/2	G/ms	(3), (5)
Vibration (Non-Operating)	V_{NOP}	-	1.5	G	(4), (5)

Note (1) Temperature and relative humidity range is shown in the figure below.

(a) 90 %RH Max. (Ta $\leqq$ 40 ºC).

(b) Wet-bulb temperature should be 39 ºC Max. (Ta > 40 ºC).

(c) No condensation .

Relative Humidity (%RH)
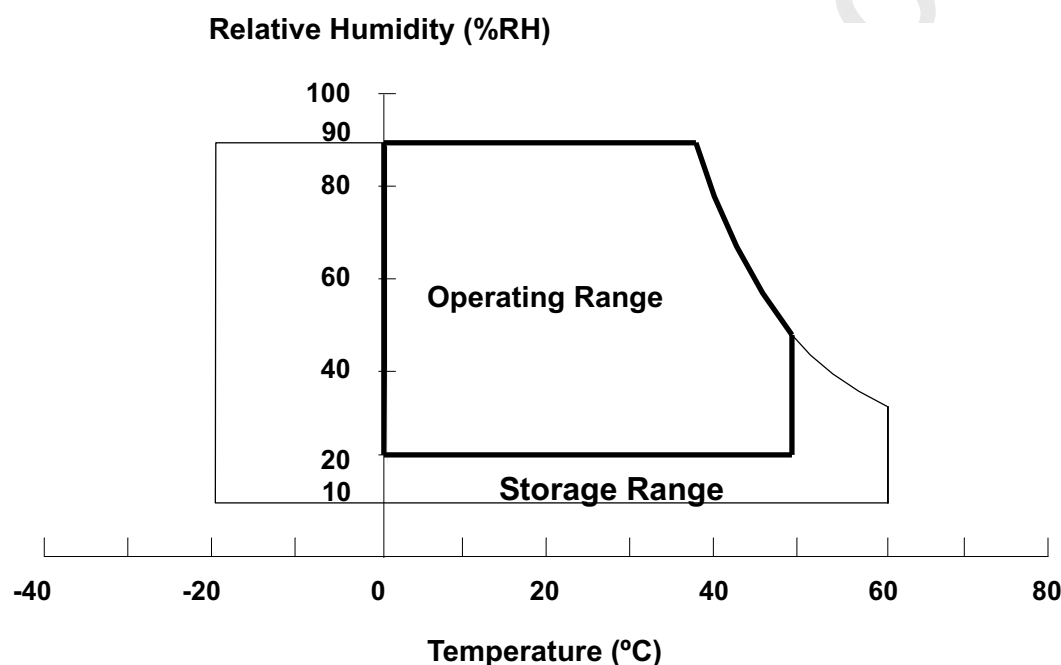
Note (2) The temperature of panel surface should be 0 ºC Min. and 50 ºC Max.
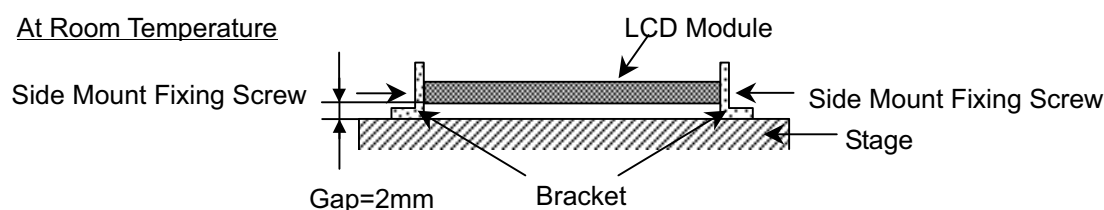
Note (3) 1 time for ± X, ± Y, ± Z. for Condition (200G / 2ms) is half Sine Wave,

Note (4) 10 ~ 200 Hz, 0.5 Hr / Cycle, 1 cycles for each X, Y, Z.

Note (5) At testing Vibration and Shock, the fixture in holding the module has to be hard and rigid enough

so that the module would not be twisted or bent by the fixture.

The fixing condition is shown as below:

Version 1.1

Preliminary

2.2 ELECTRICAL ABSOLUTE RATINGS

2.2.1 TFT LCD MODULE

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Power Supply Voltage	Vcc	-0.3	+4.0	V	(1)
Logic Input Voltage	V_{IN}	-0.3	Vcc+0.3	V	

2.2.2 BACKLIGHT UNIT

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Lamp Voltage	V_L	-	2.5K	V_{RMS}	(1), (2), I_L = (6.0) mA
Lamp Current	I_L	**2.0**	**(7.0)**	mA_{RMS}	(1), (2)
Lamp Frequency	F_L	**(50)**	**(60)**	KHz	

Note (1) Permanent damage to the device may occur if maximum values are exceeded. Function operation

should be restricted to the conditions described under Normal Operating Conditions.

Note (2) Specified values are for lamp (Refer to Section 3.2 for further information).

Version 1.1

Issued Date: Dec.05, 2005
Model No.: N154C1 -L01

Preliminary

3 ELECTRICAL CHARACTERISTICS

3.1 TFT LCD MODULE

Ta = 25 ± 2 ℃

Parameter		Symbol	Value			Unit	Note
			Min.	Typ.	Max.		
Power Supply Voltage		Vcc	3.0	3.3	3.6	V	-
Ripple Voltage		V_{RP}	-	-	100	mV	-
Rush Current		I_{RUSH}	-	-	1.5	A	(2)
Power Supply Current	White	Icc	-	(310)	(340)	mA	(3)a
	Black		-	(350)	(380)	mA	(3)b
	Vertical Stripe		-	(400)	(430)	mA	(3)c
Differential Input Voltage for LVDS Receiver Threshold	"H" Level	V_{IH}	-	-	+100	mV	-
	"L" Level	V_{IL}	-100	-	-	mV	-
Terminating Resistor		R_T	-	100	-	Ohm	-
Power per EBL WG		P_{EBL}	-	TBD	-	W	(4)

Note (1) The module should be always operated within above ranges.

Note (2) Measurement Conditions:

Vcc rising time is 470us

Version 1.1

Issued Date: Dec.05, 2005
Model No.: N154C1 -L01

Preliminary
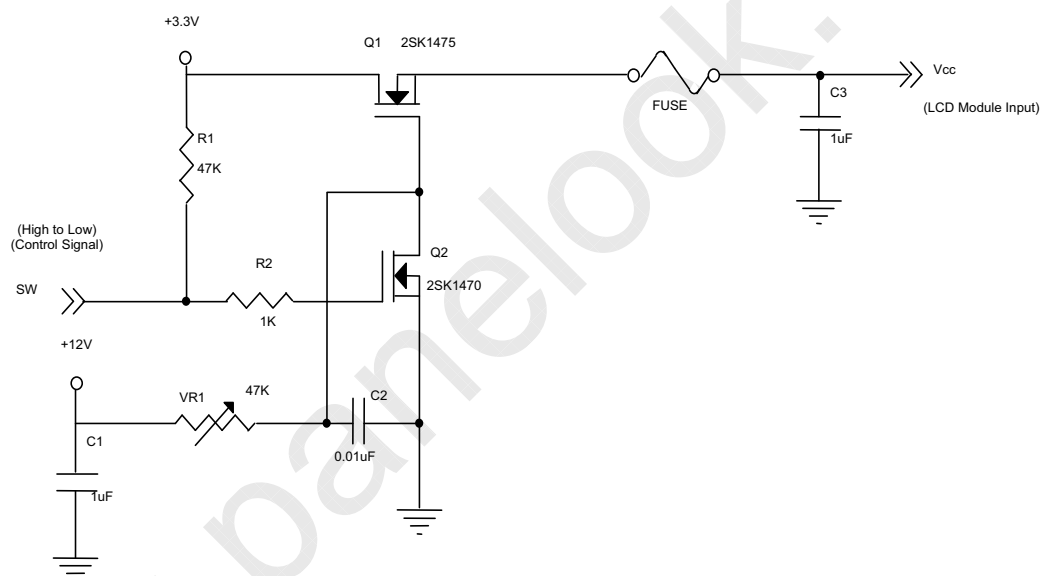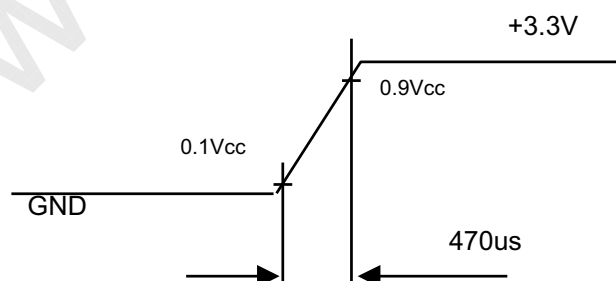
Note (3) The specified power supply current is under the conditions at Vcc = 3.3 V, Ta = 25 ± 2 ºC, DC Current and f_v = 60 Hz, whereas a power dissipation check pattern below is displayed.

a. White Pattern

Active Area

b. Black Pattern
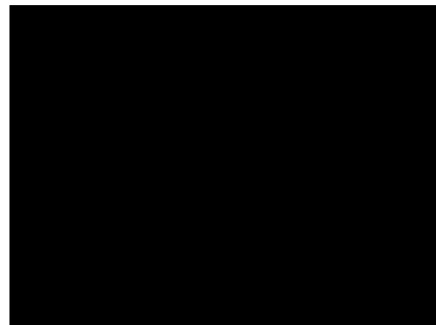
Active Area

c. Vertical Stripe Pattern
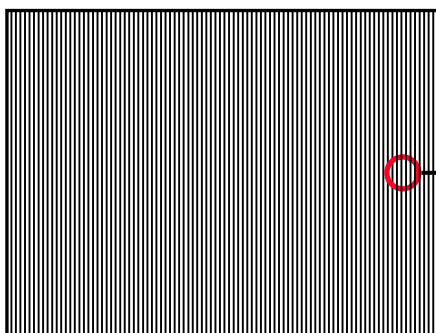
Active Area
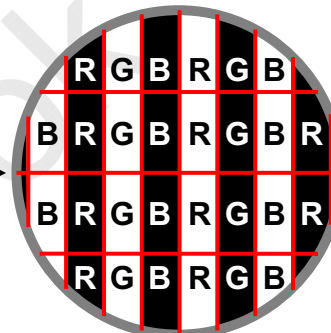
Note (4) The specified power are the sum of LCD panel electronics input power and the inverter input power. Test conditions are as follows.

(a) Vcc = 3.3 V, Ta = 25 ± 2 ºC, f_v = 60 Hz,

(b) The pattern used is a black and white 32 x 36 checkerboard, slide #100 from the VESA file "Flat Panel Display Monitor Setup Patterns", FPDMSU.ppt.

(c) Luminance: 60 nits.

(d) The inverter used is provided from XXXX(www.XXX.com). CMO doesn't provide the inverter in this product.

Version 1.1

Issued Date: Dec.05, 2005
Model No.: N154C1 -L01

Preliminary

3.2 BACKLIGHT UNIT

Ta = 25 ± 2 ºC

Parameter	Symbol	Value			Unit	Note
		Min.	Typ.	Max.		
Lamp Input Voltage	V_L	**(630)**	**(700)**	**(770)**	V_{RMS}	I_L = 6.0 mA
Lamp Current	I_L	**2.0**	**6.0**	**(7.0)**	mA_{RMS}	(1) , (8)
Lamp Turn On Voltage	V_S	-	-	**(1460) (25 ^{o}C)**	V_{RMS}	(2)
		-	-	**(1600) (0 ^{o}C)**	V_{RMS}	(2)
Operating Frequency	F_L	**(50)**	**(55)**	**(60)**	KHz	(3)
Power Consumption	P_L	**-**	**(4.6)**	-	W	(4), I_L = 6.0 mA
Lamp Life Time	L_{BL}	**(15,000)**	**-**	-	Hrs	(5)
Leakage Current	I_{IN}-I_{OUT}	-	**TBD**		mA	(7)

Note (1) Lamp current is measured by utilizing a high frequency current meter as shown below:
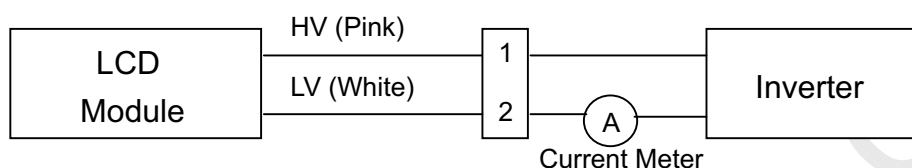
Note (2) The voltage shown above should be applied to the lamp for more than 1 second after startup. Otherwise the lamp may not be turned on.

Note (3) The lamp frequency may generate interference with horizontal synchronous frequency from the display, and this may cause line flow on the display. In order to avoid interference, the lamp frequency should be detached from the horizontal synchronous frequency and its harmonics as far as possible.

Note (4) P_L = $I_L \times V_L$

Note (5) The lifetime of lamp is defined as the time when it continues to operate under the conditions at Ta = 25 $\pm$2 ^{o}C and I_L = 6.0 mA_{RMS} until one of the following events occurs:

(a) When the brightness becomes $\leqq$ 50% of its original value.

(b) When the effective ignition length becomes $\leqq$ 80% of its original value. (Effective ignition length is defined as an area that the brightness is less than 70% compared to the center point.)

Note (6) The waveform of the voltage output of inverter must be area-symmetric and the design of the inverter must have specifications for the modularized lamp. The performance of the Backlight, such as lifetime or brightness, is greatly influenced by the characteristics of the DC-AC inverter for the lamp. All the parameters of an inverter should be carefully designed to avoid generating too much current leakage from high voltage output of the inverter. When designing or ordering the inverter please make sure that a poor lighting caused by the mismatch of the Backlight and the inverter (miss-lighting, flicker, etc.) never occurs. If the above situation is confirmed, the module should be operated in the same manners when it is installed in your instrument.

Requirements for a system inverter design, which is intended to have a better display performance, a better power efficiency and a more reliable lamp. It shall help increase the lamp lifetime and reduce its leakage current.

a. The asymmetry rate of the inverter waveform should be 10% below;

b. The distortion rate of the waveform should be within $\sqrt{2}$ ± 10%;

Version 1.1

Issued Date: Dec.05, 2005
Model No.: N154C1 -L01

Preliminary

c. The ideal sine wave form shall be symmetric in positive and negative polarities.

I_p

I_{-p}
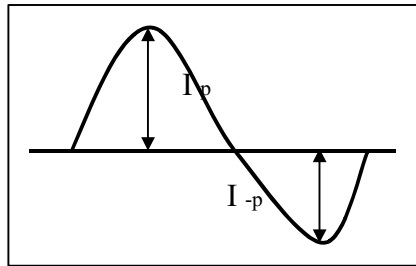
* Asymmetry rate:

$$| I_p - I_{-p} | / I_{rms} * 100\%$$

* Distortion rate

$$I_p \text{ (or } I_{-p}) / I_{rms}$$

Note (7) The lamp leakage current is measured by the current difference between in and out. And the measurement condition is as below:

LCD Module

FG

Low　　　　**High**

Lamp

Current Probe

I_{Low}

Current Probe

I_{High}

Inverter

GND

$$I_{Leak(RMS)} = I_{High(RMS)} - I_{Low(RMS)}$$
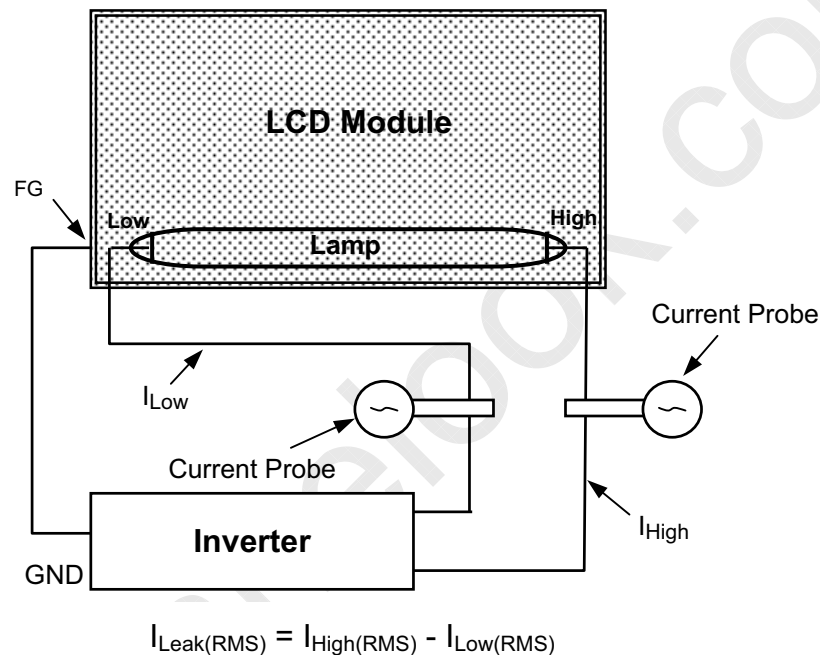
Note (8) About operating current min 2.0mA , lamp maker has some advice as below :

(Reference) Light quantity adjustment method

Explanation and comparison of the kind of tone light:

① Lamp current wave-like by the adjustment of the current.

P-P LEVEL DOWN

Tone light

YOKOGAWA♦
NORM 20k S/s
CH1 5 V
DC 100:1
2003/12/24 13:14:11
500ms/div

Filter
SMOOTH OFF
BW 20MHz
Offset
CH1 0.000V
CH2 0.0V
CH3 0V
CH4 0.0V
Record Len
MAIN: 100K
ZOOM: 100K
Delay
0.000 s
Hold Off
MIN
Trigger
AUTO
EDGE
CH1 ƒ

Max(1) 8.400V Freq(1) 101.0Hz
Min(1) -8.550V I2TY(1) 6.797E-03
Rms(1) 6.014V

YOKOGAWA♦
NORM 20k S/s
CH1 5 V
DC 100:1
2003/12/24 13:15:44
500ms/div

Filter
SMOOTH OFF
BW 20MHz
Offset
CH1 0.000V
CH2 0.0V
CH3 0V
CH4 0.0V
Record Len
MAIN: 100K
ZOOM: 100K
Delay
0.000 s
Hold Off
MIN
Trigger
AUTO
EDGE
CH1 ƒ

Max(1) 5.850V Freq(1) 67.11Hz
Min(1) -5.850V I2TY(1) 75.26E-03
Rms(1) 4.011V

Version 1.1

Issued Date: Dec.05, 2005
Model No.: N154C1　-L01

Preliminary

② Lamp current wave-like by the adjustment of the burst.

P-P LEVEL =

OFF:20%

ON:80%
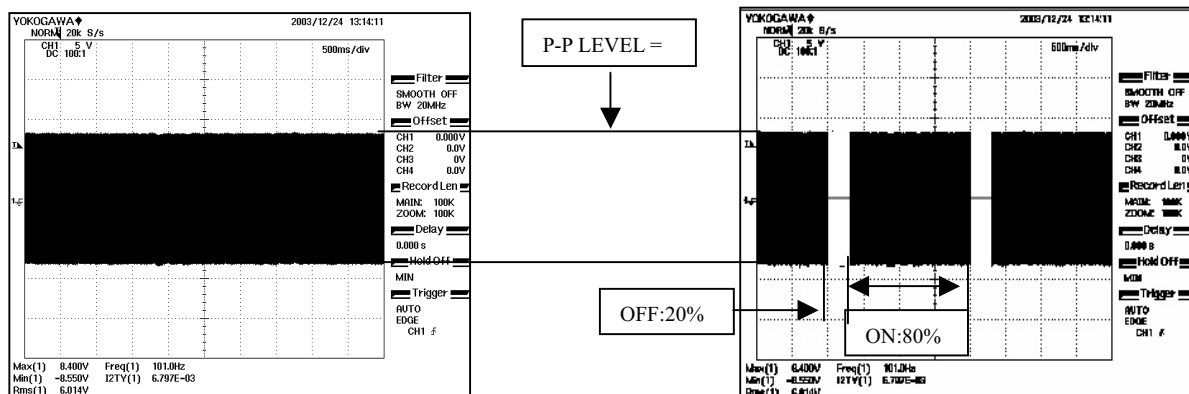
Comparative table

Method	Backlight efficiency　(INV＋LAMP)	Tone light rate (%)	Circuitry
①current	Good (75 %　～　85%)	58	Complicated
②burst	Bad (65 %　～　75%)	10	Easy

Method of case that Lamp current MIN2.0mA is controlled.

It is the setting of minimum 2.0mA (MIN) to Lamp current 6.0mA in the lamp specification. The burst is excellent for circuitry. The marker proposes that pays attention to the following contents.

The attention point of the light with a touch of the burst:

① Do not to be SPARK at start.

N　G

GOOD

SPARK
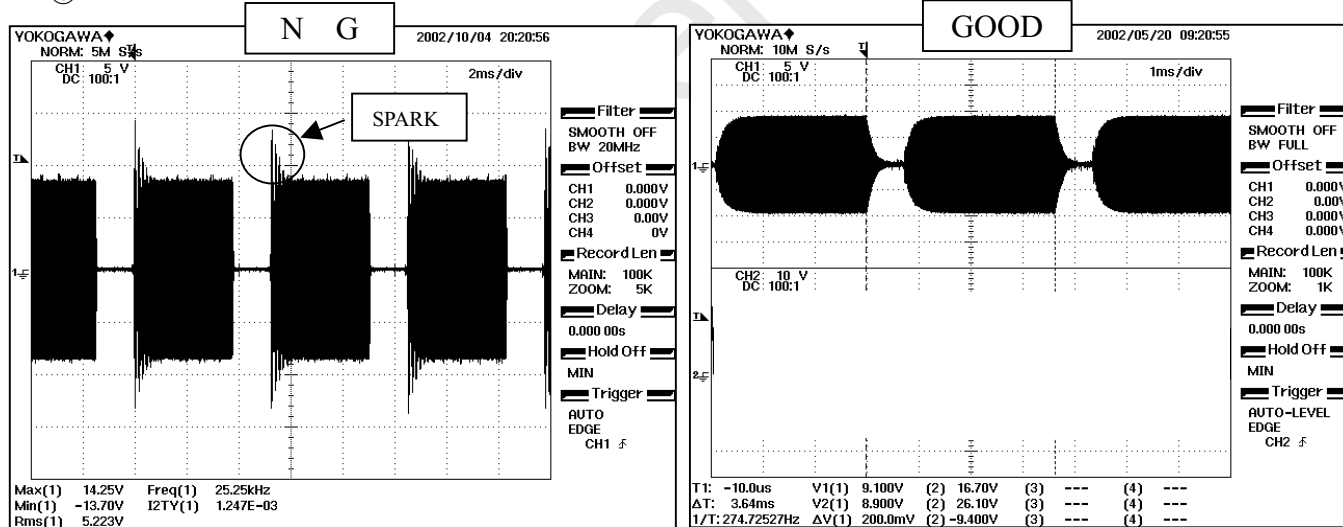
② PWM frequency does so that the frequency that is not able to divide the fixed number time, fixed number to lamp drive frequency is selected. (It is due to resonance noise occurrence prevention.) Even the frequency that is using it for LCD avoids selecting it.

Version 1.1

Issued Date: Dec.05, 2005
Model No.: N154C1 -L01
Preliminary

4   BLOCK DIAGRAM

4.1 TFT LCD MODULE

4.2 BACKLIGHT UNIT

Version 1.1

Issued Date: Dec.05, 2005
Model No.: N154C1　-L01

Preliminary
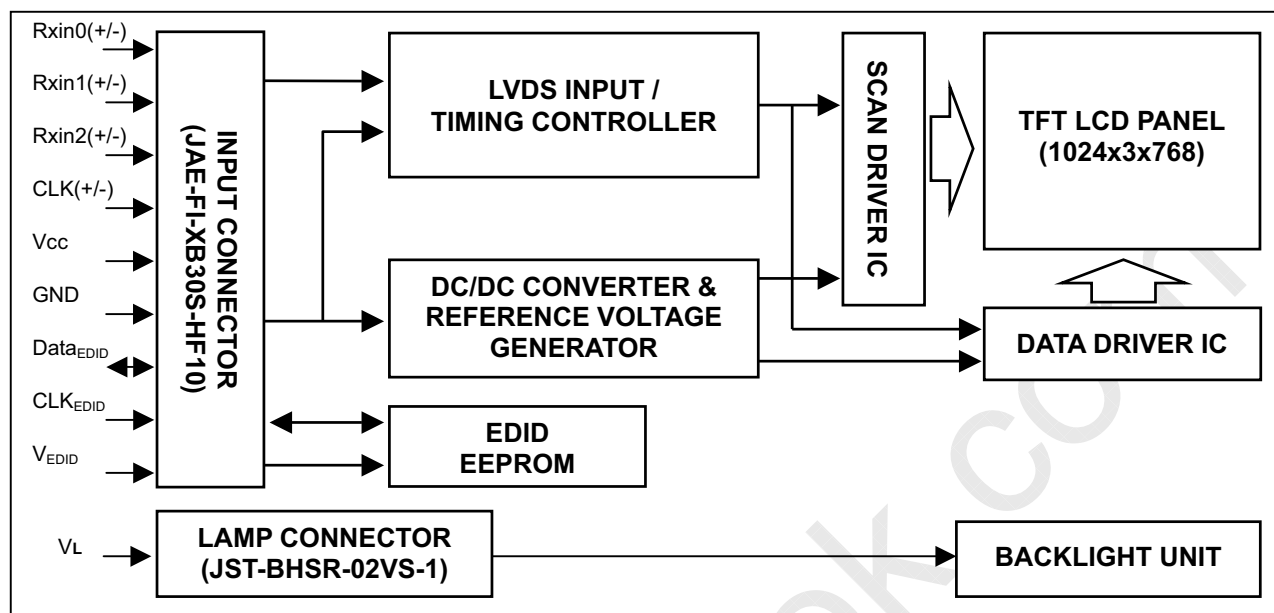
5　INPUT TERMINAL PIN ASSIGNMENT

5.1 TFT LCD MODULE

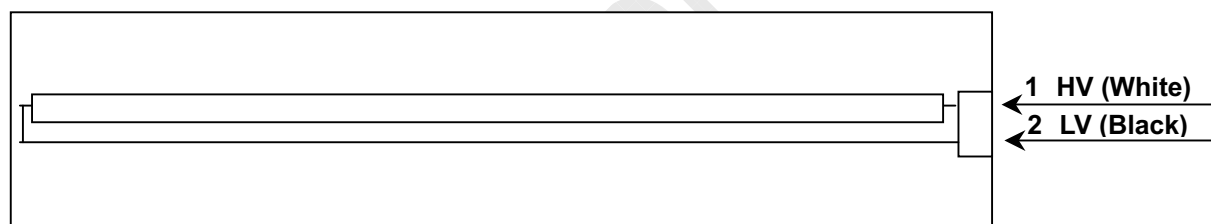| Pin	Symbol	Description	Polarity	Remark
1	Vss	Ground		
2	Vcc	Power Supply +3.3 V (typical)		
3	Vcc	Power Supply +3.3 V (typical)		
4	V_{EDID}	DDC 3.3V Power		
5	BIST	Panel BIST enable		
6	CLK_{EDID}	DDC Clock		
7	$DATA_{EDID}$	DDC Data		-
8	RXO0-	LVDS Differential Data Input (Odd)	Negative	
9	RXO0+	LVDS Differential Data Input (Odd)	Positive	
10	Vss	Ground		
11	RXO1-	LVDS Differential Data Input (Odd)	Negative	
12	RXO1+	LVDS Differential Data Input (Odd)	Positive	
13	Vss	Ground		
14	RXO2-	LVDS Differential Data Input (Odd)	Negative	
15	RXO2+	LVDS Differential Data Input (Odd)	Positive	
16	Vss	Ground		
17	RXOC-	LVDS Clock Data Input (Odd)	Negative	
18	RXOC+	LVDS Clock Data Input (Odd)	Positive	
19	Vss	Ground		
20	RxE0-	LVDS Differential Data Input (Even)	Negative	
21	RxE0+	LVDS Differential Data Input (Even)	Positive	
22	Vss	Ground		
23	RxE1-	LVDS Differential Data Input (Even)	Negative	
24	RxE1+	LVDS Differential Data Input (Even)	Positive	
25	Vss	Ground		
26	RxE2-	LVDS Differential Data Input (Even)	Negative	
27	RxE2+	LVDS Differential Data Input (Even)	Positive	
28	Vss	Ground		
29	RXEC-	LVDS Clock Data Input (Even)	Negative	
30	RXEC+	LVDS Clock Data Input (Even)	Positive	

Note (1) Connector Part No.: JAE-FI-XB30SL-HF11 or equivalent

Note (2) User's connector Part No: JAE-FI-X30C2L or equivalent

Note (3) The first pixel is odd as shown in the following figure.

Version 1.1

Issued Date: Dec.05, 2005
Model No.: N154C1 -L01

Preliminary
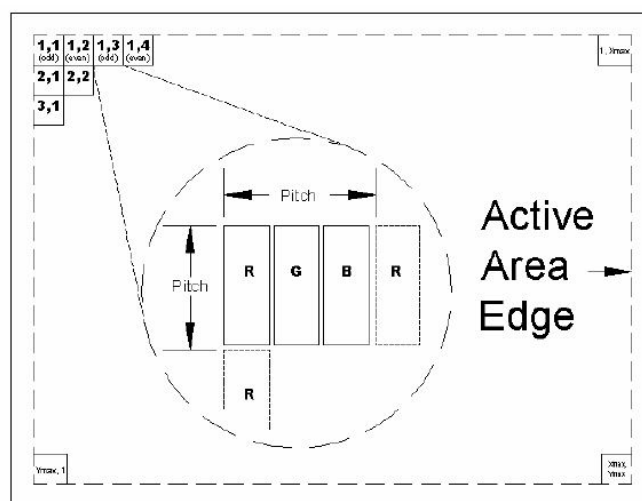
5.2 BACKLIGHT UNIT

Pin	Symbol	Description	Color
1	HV	High Voltage	White
2	LV	Ground	Black

Note (1) Connector Part No.: JST-BHSR-02VS-1 or equivalent

Note (2) User's connector Part No.: JST-SM02B-BHSS-1-TB or equivalent

5.3 TIMING DIAGRAM OF LVDS INPUT SIGNAL

Version 1.1

Issued Date: Dec.05, 2005
Model No.: N154C1 -L01

Preliminary
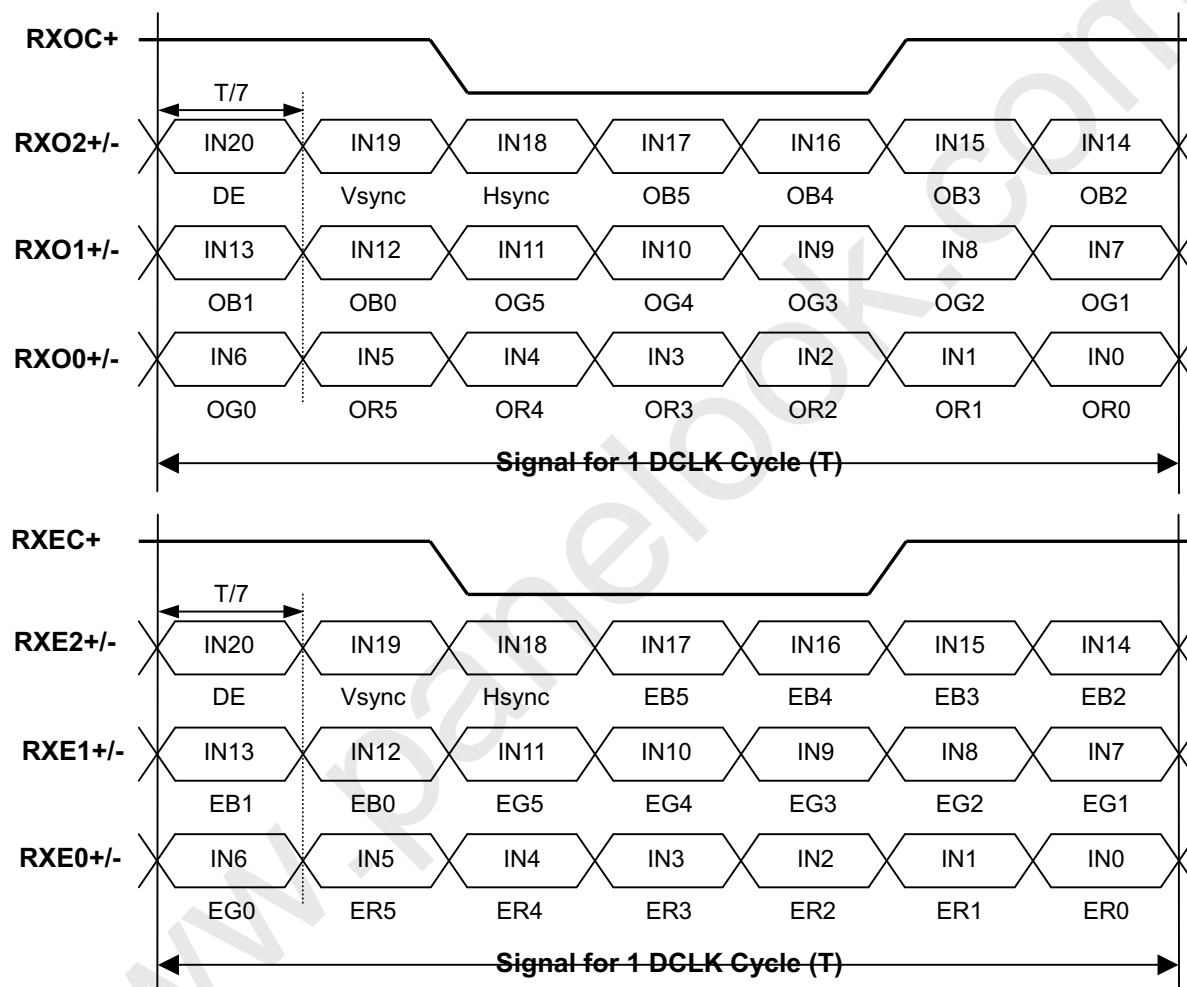
5.4 COLOR DATA INPUT ASSIGNMENT

The brightness of each primary color (red, green and blue) is based on the 6-bit gray scale data input for the color. The higher the binary input the brighter the color. The table below provides the assignment of color versus data input.

Color		Data Signal																		
		Red						Green						Blue					
		R5	R4	R3	R2	R1	R0	G5	G4	G3	G2	G1	G0	B5	B4	B3	B2	B1	B0
Basic Colors	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	Green	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
	Cyan	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1
	Magenta	1	1	1	1	1	1	0	0	0	0	0	0	1	1	1	1	1	1
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0
	White	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Gray Scale Of Red	Red(0)/Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(1)	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	Red(2)	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Red(61)	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	Red(62)	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(63)	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
Gray Scale Of Green	Green(0)/Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green(1)	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
	Green(2)	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Green(61)	0	0	0	0	0	0	1	1	1	1	0	1	0	0	0	0	0	0
	Green(62)	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0
	Green(63)	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
Gray Scale Of Blue	Blue(0)/Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Blue(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Blue(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Blue(61)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	1
	Blue(62)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0
	Blue(63)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1

Note (1) 0: Low Level Voltage, 1: High Level Voltage

Version 1.1

Issued Date: Dec.05, 2005
Model No.: N154C1 -L01

Preliminary

5.5 EDID DATA STRUCTURE

The EDID (Extended Display Identification Data) data formats are to support displays as defined in the VESA Plug & Display and FPDI standards.

Byte # (decimal)	Byte # (hex)	Field Name and Comments	Value (hex)	Value (binary)
0	0	Header	00	00000000
1	1	Header	FF	11111111
2	2	Header	FF	11111111
3	3	Header	FF	11111111
4	4	Header	FF	11111111
5	5	Header	FF	11111111
6	6	Header	FF	11111111
7	7	Header	00	00000000
8	8	EISA ID manufacturer name ("APP")	06	00000110
9	9	EISA ID manufacturer name (Compressed ASCII)	10	00010000
10	0A	ID product code (N154C1-L01)	57	01010111
11	0B	ID product code (hex LSB first; N154C1-L01)	9C	10011100
12	0C	ID S/N (fixed "0")	00	00000000
13	0D	ID S/N (fixed "0")	00	00000000
14	0E	ID S/N (fixed "0")	00	00000000
15	0F	ID S/N (fixed "0")	00	00000000
16	10	Week of manufacture (fixed "00H")	04	00000100
17	11	Year of manufacture (fixed "00H")	10	00010000
18	12	EDID structure version # ("1")	01	00000001
19	13	EDID revision # ("3")	03	00000011
20	14	Video I/P definition ("digital")	80	10000000
21	15	Max H image size ("34cm")	22	00100010
22	16	Max V image size ("22cm")	16	00010110
23	17	Display Gamma (Gamma = "2.2")	78	01111000
24	18	Feature support ("Active off, RGB Color")	0A	00001010
25	19	Red/Green (Rx1, Rx0, Ry1, Ry0, Gx1, Gx0, Gy1, Gy0)	DD	11011101
26	1A	Blue/White (Bx1, Bx0, By1, By0, Wx1, Wx0, Wy1, Wy0)	68	01101000
27	1B	Red-x (Rx = "0.593")	97	10010111
28	1C	Red-y (Ry = "0.337")	56	01010110
29	1D	Green-x (Gx = "0.315")	50	01010000
30	1E	Green-y (Gy = "0.528")	87	10000111
31	1F	Blue-x (Bx = "0.149")	26	00100110
32	20	Blue-y (By = "0.119")	1E	00011110
33	21	White-x (Wx = "0.307")	4E	01001110
34	22	White-y (Wy = "0.316")	51	01010001
35	23	Established timings 1	00	00000000
36	24	Established timings 2 (1440x900@60Hz)	00	00000000
37	25	Manufacturer's reserved timings	00	00000000
38	26	Standard timing ID # 1	01	00000001
39	27	Standard timing ID # 1	01	00000001
40	28	Standard timing ID # 2	01	00000001
41	29	Standard timing ID # 2	01	00000001

Version 1.1

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Preliminary

42	2A	Standard timing ID # 3	01	00000001
43	2B	Standard timing ID # 3	01	00000001
44	2C	Standard timing ID # 4	01	00000001
45	2D	Standard timing ID # 4	01	00000001
46	2E	Standard timing ID # 5	01	00000001
47	2F	Standard timing ID # 5	01	00000001
48	30	Standard timing ID # 6	01	00000001
49	31	Standard timing ID # 6	01	00000001
50	32	Standard timing ID # 7	01	00000001
51	33	Standard timing ID # 7	01	00000001
52	34	Standard timing ID # 8	01	00000001
53	35	Standard timing ID # 8	01	00000001
54	36	Detailed timing/monitor	9F	10011111
55	37	1440x900 @60Hz : Pixel Clock = 96.31 MHz	25	00100101
56	38	Hor active=1440 pixels	A0	10100000
57	39	Hor blanking=320 pixels	40	01000000
58	3A		51	01010001
59	3B	Vertcal active=900 lines	84	10000100
60	3C	Vertical blanking=16lines	0C	00001100
61	3D		30	00110000
62	3E	H sync. Offset=64 pixels	40	01000000
63	3F	H sync. Width=32 pixels	20	00100000
64	40	V sync. Offset=3 lines	33	00110011
65	41	V sync. Width=3 lines	00	00000000
66	42	H image size= 331 mm	4B	01001011
67	43	V image size = 207 mm	CF	11001111
68	44		10	00010000
69	45	No Horizontal Border	00	00000000
70	46	No Vertical Border	00	00000000
71	47	Non-interlaced, Normal display, No stereo, Digital separate sync, H/V pol Negatives	19	00011001
72	48	Detailed timing/monitor	00	00000000
73	49	descriptor #2	00	00000000
74	4A		00	00000000
75	4B		01	00000001
76	4C	Version	00	00000000
77	4D	Apple edid signature	06	00000110
78	4E	Apple edid signature	10	00010000
79	4F	Link Type (LVDS Link,MSB justified)	30	00110000
80	50	Pixel and link component format (6-bit panel interface)	00	00000000
81	51	Panel features (No inverter)	00	00000000
82	52		00	00000000
83	53		00	00000000
84	54		00	00000000
85	55		00	00000000
86	56		00	00000000
87	57		00	00000000

Version 1.1

Issued Date: Dec.05, 2005
Model No.: N154C1 -L01

Preliminary

| 88	58		0A	00001010
89	59		20	00100000
90	5A	Detailed timing description # 3	00	00000000
91	5B	# 3 Flag	00	00000000
92	5C	# 3 Reserved	00	00000000
93	5D	# 3 FE (hex) defines ASCII string (Model Name"N154C1-L01", ASCII)	FE	11111110
94	5E	# 3 Flag	00	00000000
95	5F	# 3 1st character of name ("N")	4E	01001110
96	60	# 3 2nd character of name ("1")	31	00110001
97	61	# 3 3rd character of name ("5")	35	00110101
98	62	# 3 4th character of name ("4")	34	00110100
99	63	# 3 5th character of name ("C")	43	01000011
100	64	# 3 6th character of name ("1")	31	00110001
101	65	# 3 7th character of name ("-")	2D	00101101
102	66	# 3 8th character of name ("L")	4C	01001100
103	67	# 3 9th character of name ("0")	30	00110000
104	68	# 3 9th character of name ("1")	31	00110001
105	69	# 3 New line character indicates end of ASCII string	0A	00001010
106	6A	# 3 Padding with "Blank" character	20	00100000
107	6B	# 3 Padding with "Blank" character	20	00100000
108	6C	Detailed timing description # 4	00	00000000
109	6D	# 4 Flag	00	00000000
110	6E	# 4 Reserved	00	00000000
111	6F	# 4 FC (hex) defines Monitor name ("Color LCD", ASCII)	FC	11111100
112	70	# 4 Flag	00	00000000
113	71	# 4 1st character of name ("C")	43	01000011
114	72	# 4 2nd character of name ("o")	6F	01101111
115	73	# 4 3rd character of name ("l")	6C	01101100
116	74	# 4 4th character of name ("o")	6F	01101111
117	75	# 4 5th character of name ("r")	72	01110010
118	76	# 4 6th character of name (<space>)	20	00100000
119	77	# 4 7th character of name ("L")	4C	01001100
120	78	# 4 8th character of name ("C")	43	01000011
121	79	# 4 9th character of name ("D")	44	01000100
122	7A	# 4 New line character # 4 indicates end of Monitor name	0A	00001010
123	7B	# 4 Padding with "Blank" character	20	00100000
124	7C	# 4 Padding with "Blank" character	20	00100000
125	7D	# 4 Padding with "Blank" character	20	00100000
126	7E	Extension flag	00	00000000
127	7F	Checksum	DD	11011101

Version 1.1

6 INTERFACE TIMING
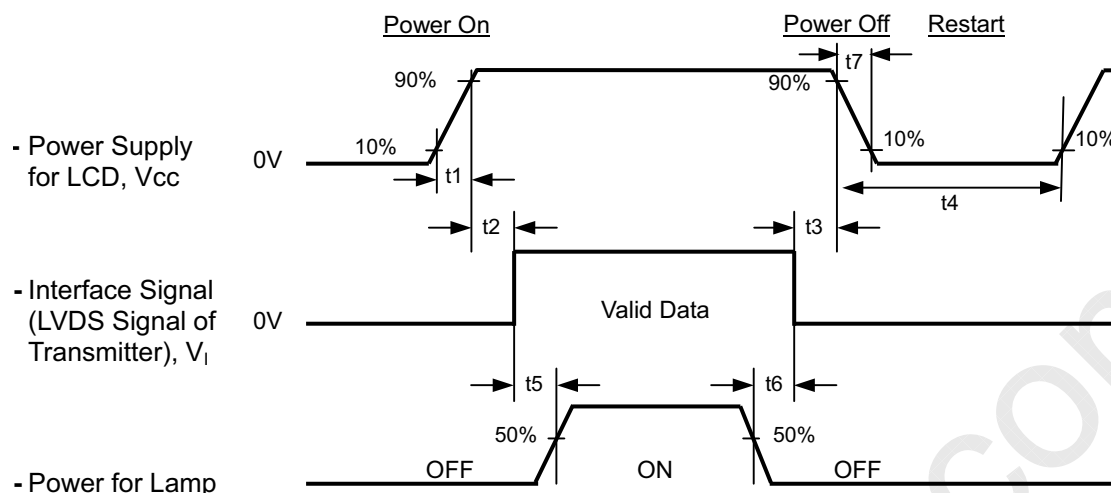
6.1 INPUT SIGNAL TIMING SPECIFICATIONS

The input signal timing specifications are shown as the following table and timing diagram.

Signal	Item	Symbol	Min.	Typ.	Max.	Unit	Note
DCLK	Frequency	1/Tc	25	44.5	60	MHz	-
DE	Vertical Total Time	TV	910	926	1500	TH	-
	Vertical Addressing Time	TVD	900	900	900	TH	-
	Horizontal Total Time	TH	760	800	880	Tc	-
	Horizontal Addressing Time	THD	720	720	720	Tc	-

INPUT SIGNAL TIMING DIAGRAM

Version 1.1
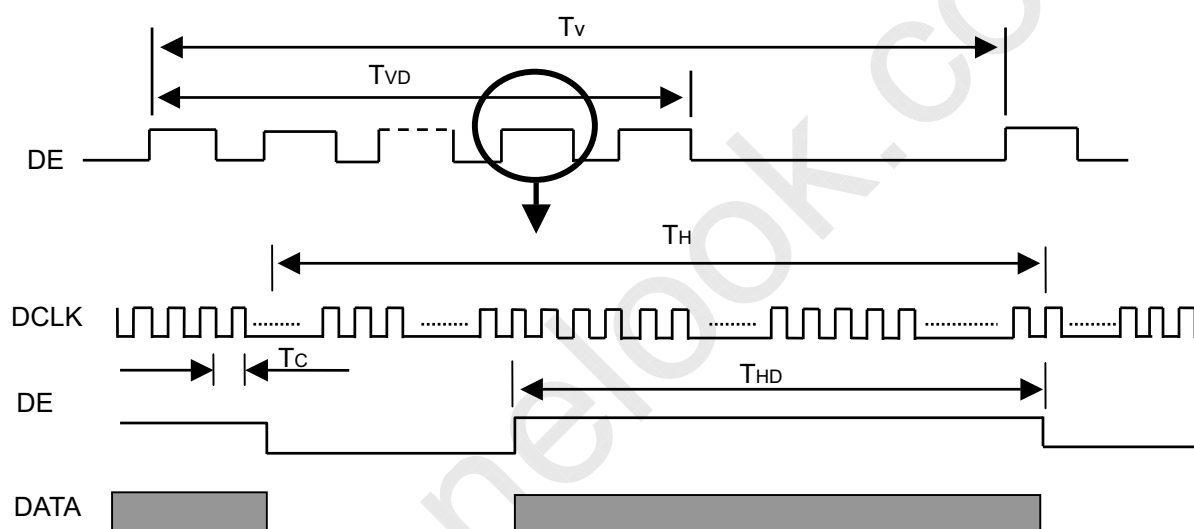
6.2 POWER ON/OFF SEQUENCE

Timing Specifications:

$$0.5 \leq t1 \leq 10 \text{ msec}$$

$$0 < t2 \leq 50 \text{ msec}$$

$$0 < t3 \leq 50 \text{ msec}$$

$$t4 \geq 500 \text{ msec}$$

$$t5 \geq 200 \text{ msec}$$

$$t6 \geq 200 \text{ msec}$$

Note (1) Please avoid floating state of interface signal at invalid period.

Note (2) When the interface signal is invalid, be sure to pull down the power supply of LCD Vcc to 0 V.

Note (3) The Backlight inverter power must be turned on after the power supply for the logic and the interface signal is valid. The Backlight inverter power must be turned off before the power supply for the logic and the interface signal is invalid.

Note (4) Sometimes some slight noise shows when LCD is turned off (even backlight is already off). To avoid this phenomenon, we suggest that the Vcc falling time had better to follow

$$t7 \geq 5 \text{ msec}$$

Version 1.1

Issued Date: Dec.05, 2005
Model No.: N154C1   -L01

Preliminary

7   OPTICAL CHARACTERISTICS

7.1 TEST CONDITIONS

Item	Symbol	Value	Unit
Ambient Temperature	Ta	25±2	°C
Ambient Humidity	Ha	50±10	%RH
Supply Voltage	V_{CC}	3.3	V
Input Signal	According to typical value in "3. ELECTRICAL CHARACTERISTICS"		
Inverter Current	I_L	6.0	mA
Inverter Driving Frequency	F_L	**61**	KHz
Inverter	Sumida-H05-4915		

The measurement methods of optical characteristics are shown in Section 7.2. The following items should be measured under the test conditions described in Section 7.1 and stable environment shown in Note (6).

7.2 OPTICAL SPECIFICATIONS

Item		Symbol		Condition	Min.	Typ.	Max.	Unit	Note
Contrast Ratio		CR			**300**	**400**	**-**	-	(2), (5)
Response Time		T_R			**-**	**8**	**12**	ms	(3)
		T_F			**-**	**23**	**28**	ms	
Luminance of White		L_{AVE}			(250)	300	-	cd/m^2	(4), (5)
White Variation		δW	5pts		-	-	(1.3)	-	(5), (6)
Color Chromaticity	Red	Rx		$\theta_x=0°$, $\theta_Y=0°$ Viewing Normal Angle	TYP -0.03	(0.592)	TYP +0.03	-	(1)
		Ry				(0.338)		-	
	Green	Gx				(0.322)		-	
		Gy				(0.531)		-	
	Blue	Bx				(0.151)		-	
		By				(0.126)		-	
	White	Wx				0.313		-	
		Wy				0.329		-	
Viewing Angle	Horizontal	θ_x+		CR≥10	(55)	(65)	-	Deg.	
		θ_x-			(55)	(65)	-		
	Vertical	θ_Y+			(40)	(50)	-		
		θ_Y-			(50)	(60)	-		

Version 1.1

Preliminary

Note (1)   Definition of Viewing Angle (θx, θy):
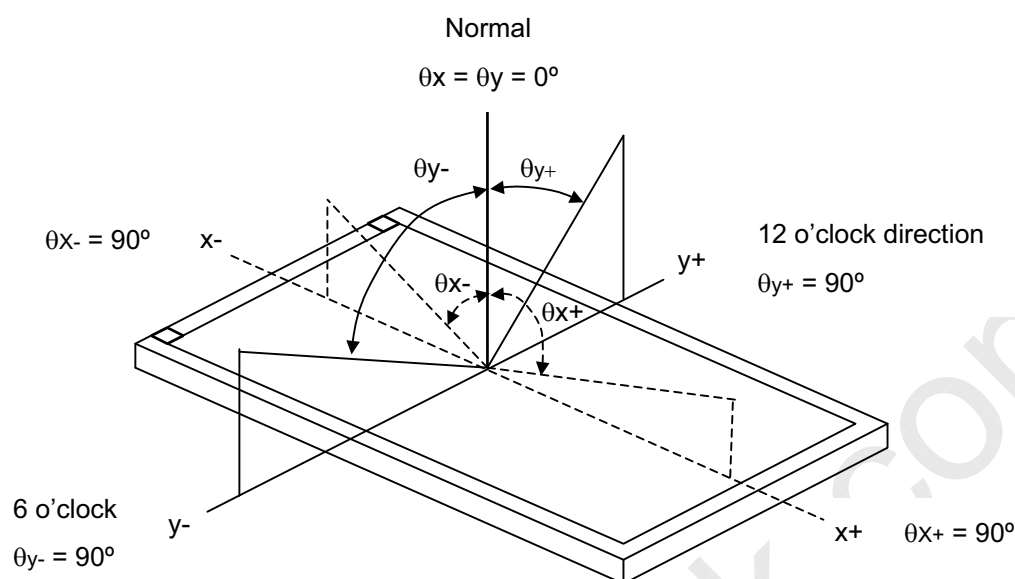
Note (2) Definition of Contrast Ratio (CR):

The contrast ratio can be calculated by the following expression.
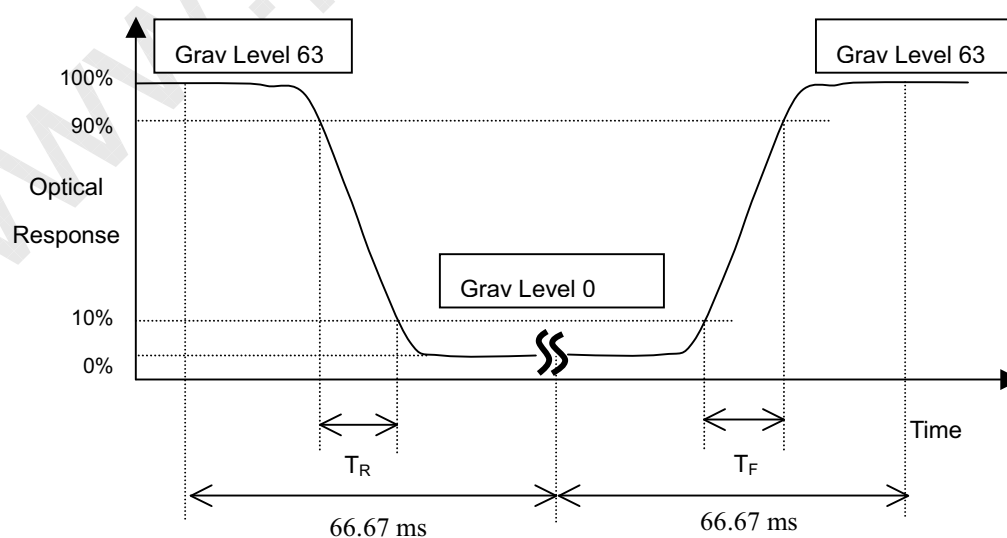
Contrast Ratio (CR) = L63 / L0

L63: Luminance of gray level 63

L 0: Luminance of gray level 0

CR = CR (5)

CR (X) is corresponding to the Contrast Ratio of the point X at Figure in Note (6).

Note (3) Definition of Response Time (T_R, T_F):

Version 1.1

Issued Date: Dec.05, 2005
Model No.: N154C1　-L01

Preliminary

Note (4) Definition of Average Luminance of White (L_{AVE}):
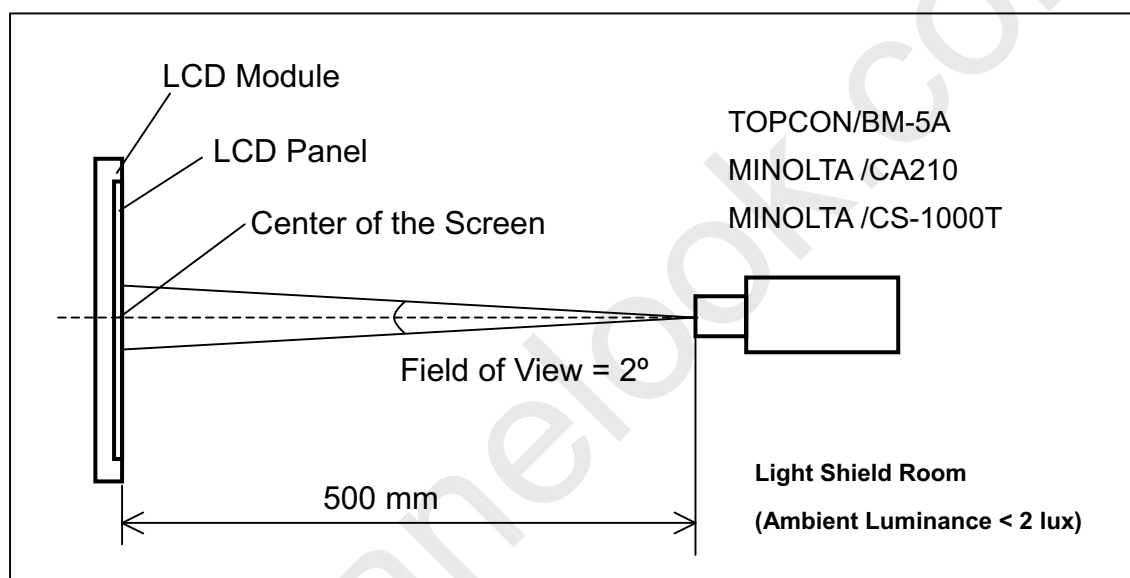
　　　　Measure the luminance of gray level 63 at 5 points

　　　　$L_{AVE} = [L\,(1)+ L\,(2)+ L\,(3)+ L\,(4)+ L\,(5)] / 5$

　　　　L (x) is corresponding to the luminance of the point X at Figure in Note (6).
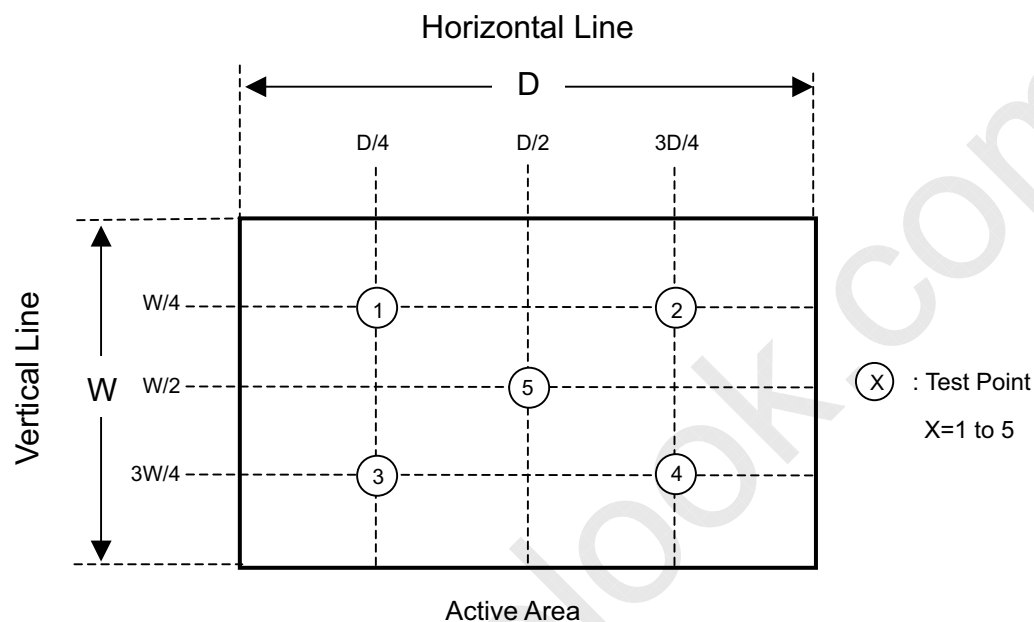

Note (5) Measurement Setup:

　　　　The LCD module should be stabilized at given temperature for 15 minutes to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 15 minutes in a windless room.

LCD Module

LCD Panel

Center of the Screen

TOPCON/BM-5A

MINOLTA /CA210

MINOLTA /CS-1000T

Field of View = 2º

500 mm

Light Shield Room

(Ambient Luminance < 2 lux)

24 / 29

Version 1.1

Note (6) Definition of White Variation (δW):

Measure the luminance of gray level 63 at 5 points

δW_{5p} = Maximum [L (1) ~ L (5)] / Minimum [L (1) ~ L (5)]

Horizontal Line

Active Area

Issued Date: Dec.05, 2005
Model No.: N154C1 -L01

Preliminary

8 PRECAUTIONS

8.1 HANDLING PRECAUTIONS

(1) The module should be assembled into the system firmly by using every mounting hole. Be careful not to twist or bend the module.

(2) While assembling or installing modules, it can only be in the clean area. The dust and oil may cause electrical short or damage the polarizer.

(3) Use fingerstalls or soft gloves in order to keep display clean during the incoming inspection and assembly process.

(4) Do not press or scratch the surface harder than a HB pencil lead on the panel because the polarizer is very soft and easily scratched.

(5) If the surface of the polarizer is dirty, please clean it by some absorbent cotton or soft cloth. Do not use Ketone type materials (ex. Acetone), Ethyl alcohol, Toluene, Ethyl acid or Methyl chloride. It might permanently damage the polarizer due to chemical reaction.

(6) Wipe off water droplets or oil immediately. Staining and discoloration may occur if they left on panel for a long time.

(7) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contacting with hands, legs or clothes, it must be washed away thoroughly with soap.

(8) Protect the module from static electricity, it may cause damage to the C-MOS Gate Array IC.

(9) Do not disassemble the module.

(10) Do not pull or fold the lamp wire.

(11) Pins of I/F connector should not be touched directly with bare hands.
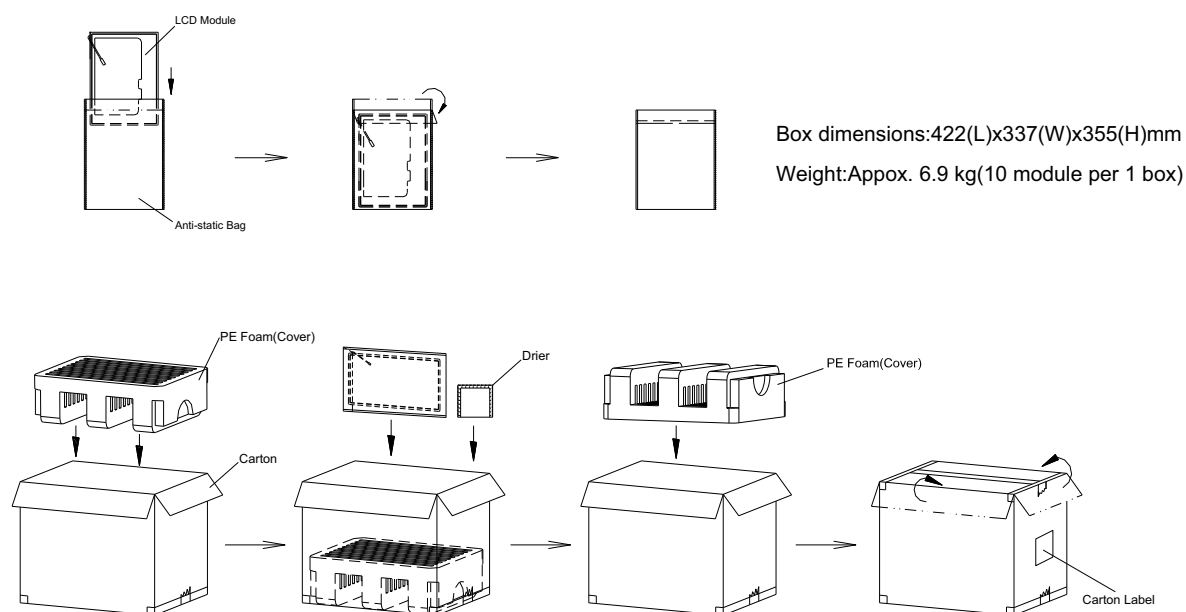
8.2 STORAGE PRECAUTIONS

(1) High temperature or humidity may reduce the performance of module. Please store LCD module within the specified storage conditions.

(2) It is dangerous that moisture come into or contacted the LCD module, because the moisture may damage LCD module when it is operating.

(3) It may reduce the display quality if the ambient temperature is lower than 10 ºC. For example, the response time will become slowly, and the starting voltage of lamp will be higher than the room temperature.

8.3 OPERATION PRECAUTIONS

(1) Do not pull the I/F connector in or out while the module is operating.

(2) Always follow the correct power on/off sequence when LCD module is connecting and operating. This can prevent the CMOS LSI chips from damage during latch-up.

(3) The startup voltage of Backlight is approximately 1000 Volts. It may cause electrical shock while assembling with inverter. Do not disassemble the module or insert anything into the Backlight unit.

Version 1.1

Issued Date: Dec.05, 2005
Model No.: N154C1 -L01

Preliminary

9   PACKING

9.1 CARTON

Box dimensions:422(L)x337(W)x355(H)mm

Weight:Appox. 6.9 kg(10 module per 1 box)

9.2 PALLET

Corner Protector:L1350mm*50mm*50mm
Pallet:L1050*W870*H135mm
Pallet Stock Dim:L1050*W870*H1555mm
weight:Approx.185kg

PE Sheet

Film

Carton Label

Corner Protector

PP Belt

Pallet

Version 1.1

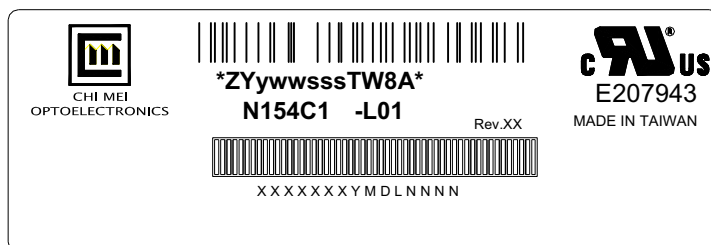Issued Date: Dec.05, 2005
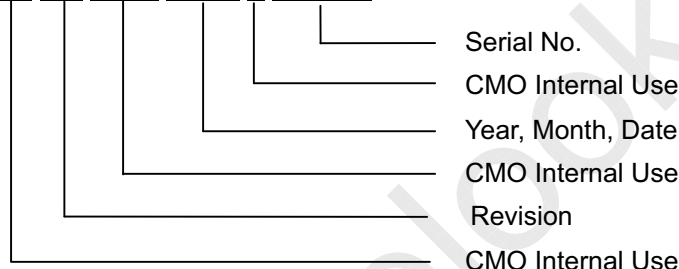Model No.: N154C1 -L01

Preliminary
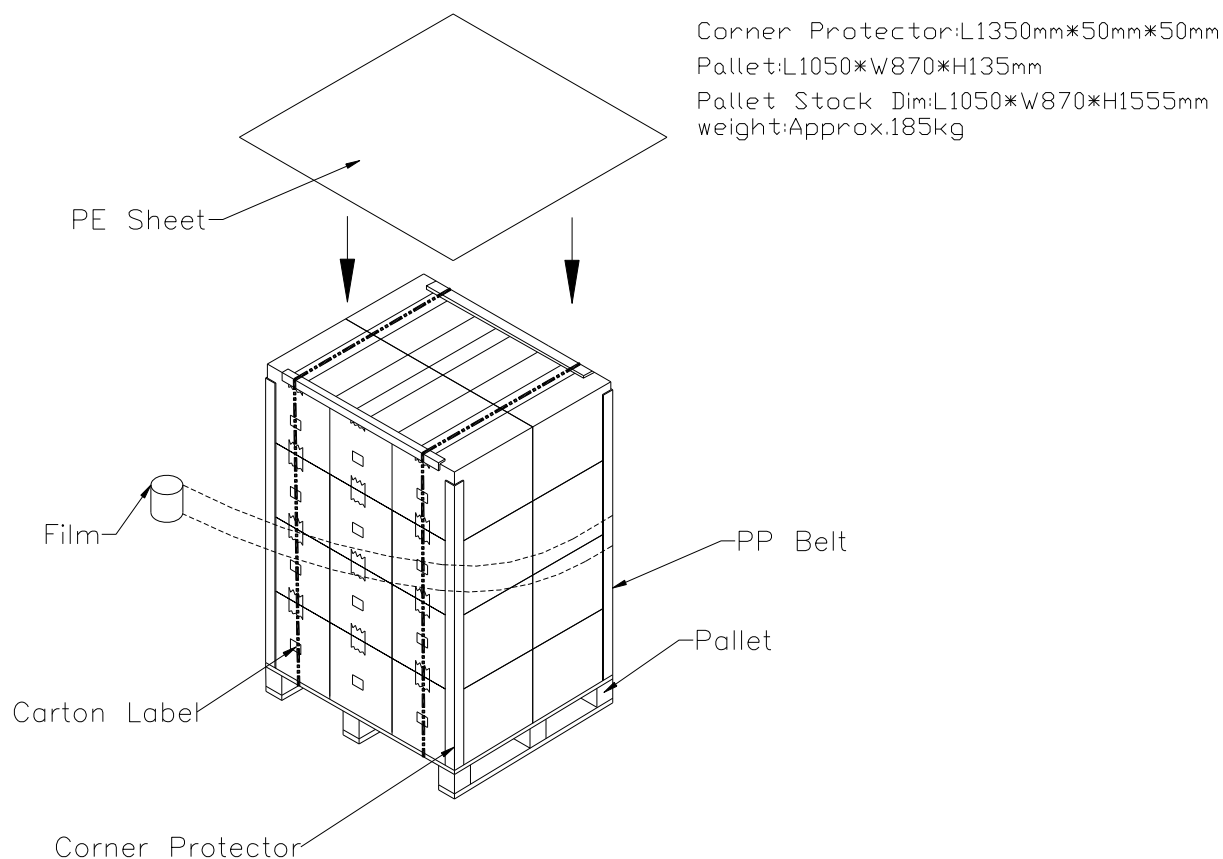
10 DEFINITION OF LABELS

10.1 CMO MODULE LABEL

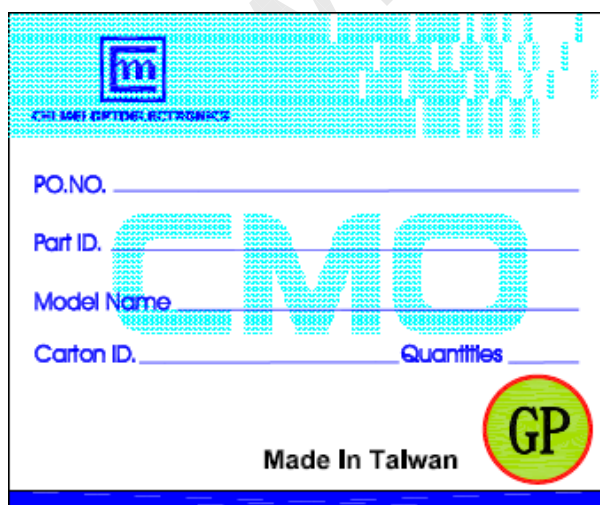The barcode nameplate is pasted on each module as illustration, and its definitions are as following explanation.

ZYywwsssTW8A
N154C1 -L01
Rev.XX

X X X X X X X Y M D L N N N N

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E207943
MADE IN TAIWAN

(a) Model Name: N154C1 - L01

(b) Revision: Rev. XX, for example: A1, …, C1, C2 …etc.

(c) Serial ID: X X X X X X X Y M D X N N N N

Serial No.
CMO Internal Use
Year, Month, Date
CMO Internal Use
Revision
CMO Internal Use

Serial ID includes the information as below:

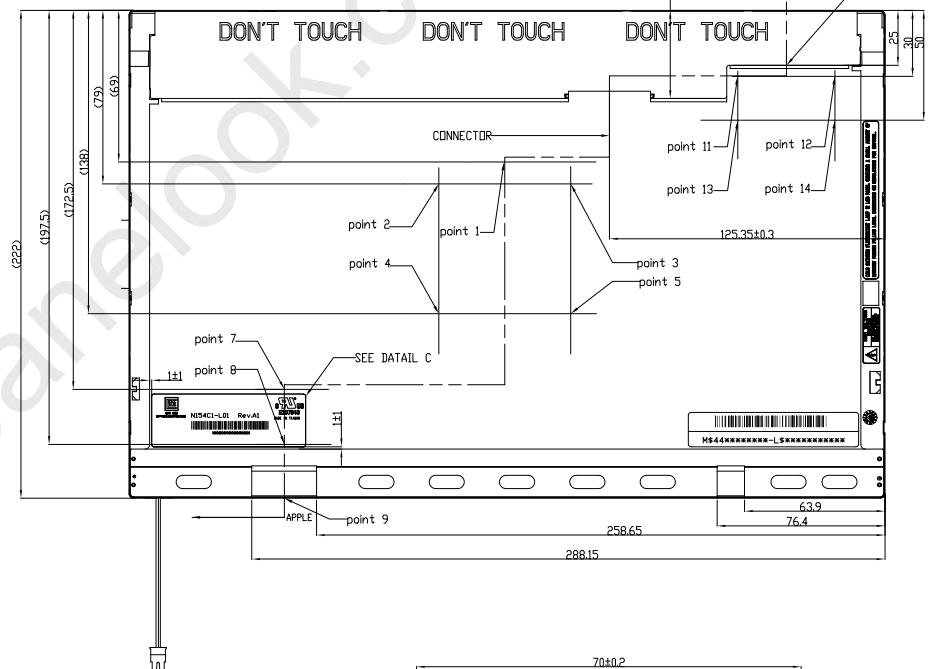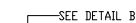(a) Manufactured Date: Year: 1~9, for 2001~2009

Month: 1~9, A~C, for Jan. ~ Dec.

Day: 1~9, A~Y, for 1st to 31st, exclude I , O and U

(b) Revision Code: cover all the change

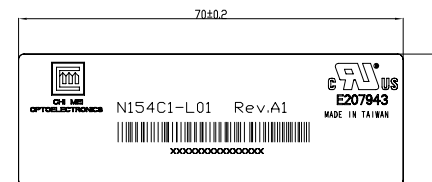(c) Serial No.: Manufacturing sequence of product

10.1 CARTON LABEL

PO.NO.
Part ID.
Model Name
Carton ID. _____ Quantities _____

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CMO

Made In Taiwan

GP

28 / 29

Version 1.1

DETAIL A

2-0.90X45°

DETAIL B

0.90X45°

SEE DETAIL A

SEE DETAIL B

DON'T TOUCH   DON'T TOUCH   DON'T TOUCH

APPLE

point 10

CONNECTOR

point 11   point 12

point 13   point 14

40.1 LVDS CONNECTOR FACE

3.86 (4.07 MAX) POINT10
3.52 (4.11 MAX) POINT11 & 12
4.97 (6.10 MAX) CONNECTOR
3.72 (4.29 MAX) POINT13 & 14
3.91 (4.44 MAX) POINT1
4.01 (4.53 MAX) POINT2 & 3

125.35±0.3

point 2   point 1
point 4
point 3
point 5

4.59 (5.03 MAX) POINT4 & 5
4.69 (5.11 MAX) POINT6

point 7
point 8
SEE DATAIL C

4.93 (5.32 MAX) POINT 7

1±1
1±1

N154C1-L01 Rev.A1

M$44*********-L$*********

5.18 (5.53 MAX) POINT8 & 15

5.5 (6.00 MAX) POINT9 & 16

APPLE
point 9

63.9
76.4

258.65

288.15

344±0.5
165.78±0.3
331.56 (ACTIVE AREA)
335±0.3 (BEZEL OPENING)
103.613±0.3
222±0.5
207.225 (ACTIVE AREA)
210.7±0.3 (BEZEL OPENING)

6.2 MAX
1.74
1.72
2-11.85±0.3
2-65.85±0.3
2-156.15±0.3
2-209.85±0.3

(79)
(69)
(138)
(172.5)
(197.5)
(222)

13.4±0.3
8-M2*P0.4
2.5 MAX
1.74
68±4
1.72

A   A

SECTION APPLE-APPLE

NOTES:
1."*" MARKS THE DESIGN CRITICAL DIMENSION.
2." ⓟ " MARKS THE PROCESS CRITICAL DIMENSION.
3.MAX.SCREW LENGTH: 2.5 mm.
4.MAX.SCREW TORQUE: 2.0 kgf-cm.
5.SIGNAL INTERFACE CONNECTOR: FI-XB30SRL-HF11 (JAE)
6.CCFL CONNECTOR: BHSR-02VS-1 (JST)

R0.40 ALL AROUND

SECTION A-A

70±0.2

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N154C1-L01 Rev.A1

cⓊus
E207943
MADE IN TAIWAN

xxxxxxxxxxxxxxx

24±0.2

SCALE 2:1
DATAIL C

TITLE	ASSY_MODULE_N154C1		2D REV. 2
			3D REV.
Approved	DAVIS WANG	Drawing No.	N154B41012
Checked	YULE LIN	Part No.	TBD
Drawer	ERIC CHANG	Material	TBD	Sheet 1 / 1	A1
Designer	ERIC CHANG	Date 5-SEP-2005	Scale 1:1	Unit:mm

| ⚠ | Cancel BLU Label Dimension | 5-SEP-2005 | ERIC CHANG | YULE LIN | | |
| Mark | Description | Date | Changed_By | Approved_By | ECN No. | Remark |

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